



SAMPLING AND ANALYSIS PLAN

DOMINGO RAILROAD DUMPSITE- CERCLIS #: NM0000605391

**Pueblo of Santo Domingo
New Mexico**

PREPARED BY:

**ALL INDIAN PUEBLO COUNCIL
PUEBLO OFFICE OF ENVIRONMENTAL PROTECTION**

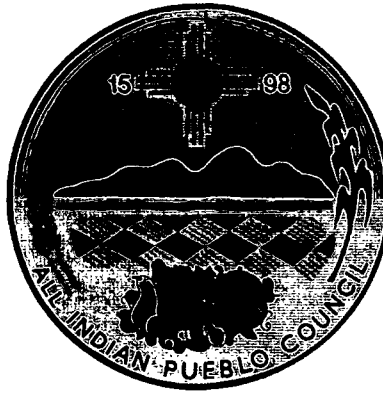
SUBMITTED TO:

**U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION VI, DALLAS, TEXAS**

December 14, 2001

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Domingo Railroad Dumpsite

SANTO DOMINGO PUEBLO, NEW MEXICO

CERCLIS #: NM0000605391

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PUEBLO OFFICE OF ENVIRONMENTAL PROTECTION**

December 14, 2001

Prepared By:

**Lisa Maiola
Environmental Scientist**

Reviewed By:

**Linda Butler
Sr. Environmental Scientist**

Approved By:

**Syed Rizvi
Program Manager**

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1.0 INTRODUCTION

Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), the U.S. Environmental Protection Agency (EPA) Region VI has recommended the All Indian Pueblo Council, Pueblo Office of Environmental Protection (POEP) to conduct a Site Inspection (SI) at the Domingo Railroad Dumpsite. The CERCLIS identification number for this site is NM0000605391. The principal objective of this sampling investigation is to identify the presence of hazardous substances associated with the historical uses of this site.

The sampling activities are planned for a January-February timeframe and will be conducted by POEP Superfund staff. This Sampling and Analysis Plan ("SAP") describes the minimum requirements for sampling and data collection activities to meet the requirements of the SI. Specific procedures and instructions to be implemented, and a description of the equipment and materials to be used to meet the sampling requirements of this SAP is provided in the report. This information along with the results of the data collection will be presented in the final site inspection report.

2.0 CONTACTS

Pueblo of Santo Domingo
New Mexico 87052
Telephone: (505) 465-2214
Ramon C. Garcia, Governor
Leandro Garcia, Tribal Programs Administrator

U.S. Environmental Protection Agency, Region 6
1445 Ross Avenue, Suite 700, Dallas, Texas 75202-2733
Telephone (214) 665-6666
LaDonna Walker, Site Assessment Manager

All Indian Pueblo Council
Pueblo Office of Environmental Protection
P.O. Box 400, 123 4th Street SW
Albuquerque, New Mexico 87103
Telephone: (505) 884-0480
Lisa Maiola, Project Manager, Extension 555
Linda Butler, Sr. Environmental Scientist, Extension 547
Damon Reyes, Safety Officer, Extension 590

3.0 SITE BACKGROUND AND DESCRIPTION

3.1 Site Location

Santo Domingo Pueblo, whose population is approximately 4136, is located in the north-central part of the state of New Mexico within the boundaries of Sandoval County (Reference 1). Domingo Railroad Dumpsite can be found traveling North on I-25 from Albuquerque for 33 miles,

exit 259, turn left on state road 22 go 4 miles, exit at ISR88 and circle around, turn left for approximately $\frac{3}{4}$ of a mile, site is on the right hand side of the road (figure 1.0, 2.0). The geographic coordinates for Domingo Railroad Dumpsite are $35^{\circ} 30' 37''$ N Latitude and $106^{\circ} 19' 3''$ W Longitude, in the SE $\frac{1}{4}$, SW $\frac{1}{4}$, of Section 2, Township 15 North and Range 6 East of the Santo Domingo Pueblo Quadrangle (Reference 1). The Domingo Railroad Dumpsite covers approximately about 62, 400 sq. meters of the site.

3.2 Site Description

The site area is located in a rural residential setting with foothills surrounding the site. The site area is characterized by a semi-arid climate with average temperatures ranging from 22° Fahrenheit (F) to 47° F in the winter months and 58° F to 88° F during the summer. The net annual precipitation for this area is 12.58 inches and the 2-year, 24-hour precipitation is 1.20 inches (Reference 1). Domingo Railroad Dumpsite is located on a relatively flat terrain, along the ATSF Railroad running west to east. Along the railroad are remains of an old railroad spur which passes through the center of the site. Galisteo Creek, an intermittent stream, runs north to south of the railroad. An arroyo runs parallel to the creek as well as a berm. There is another berm/road located on the west side of the site. At this time we have not determined the function whether it be a berm or a road. On the west side of the site between the berm/road and the spur there are remnants of a foundation. The structure and its use is unknown at this time. Farther west are more remnants of a foundation. The use at this time is also unknown. There is a depression at the surface where the spur and the berm/road join, on the south side of the site. The site area is now used for cattle grazing. The site has metal debris and garbage was scattered throughout. Vegetation consists of rabbit brush, cactus, grasses, and thistle. Biological indicators that were observed were a corral snake, lizards, and prairie dogs (Reference 1).

3.3 Operational History

Operational history of Domingo Railroad Dumpsite dates back as early as the 1900's. The ATSF Railroad operation spur was used for the switching of boxcars, loading, and from resident observation, used as a place to dump materials (Reference 1). It was also learned through personal testimony of the citizens of Santo Domingo that a huge pit for dumping was dug out and railroad waste including a whole caboose is buried at the site. During this time, there was a settlement as evidence by the remains of the foundations found during the site reconnaissance. It was understood by Superfund staff through oral history from a tribal official/resident of Santo Domingo that there was a detonation of material on the site about 8-10 years ago. At this time, there was a concrete box that was found with a padlock, inside the box the material was found and detonated and the whole area had to be evacuated (Photo 2). It is unknown at this time what kind of material this was. During site observations, the presence of berms, the railroad spur, evidence of industrial development (large foundation structures), and the data from the report and the historical photographic Analysis (EPA, 2001) confirm the site to have been used for Railroad activities. The flat characteristics of the terrain, (leveling/grading), the man-made berms, and verbal testimony lead to the idea that this site was also used for burying wastes (Photo 1,3,4).

Figure 1.0

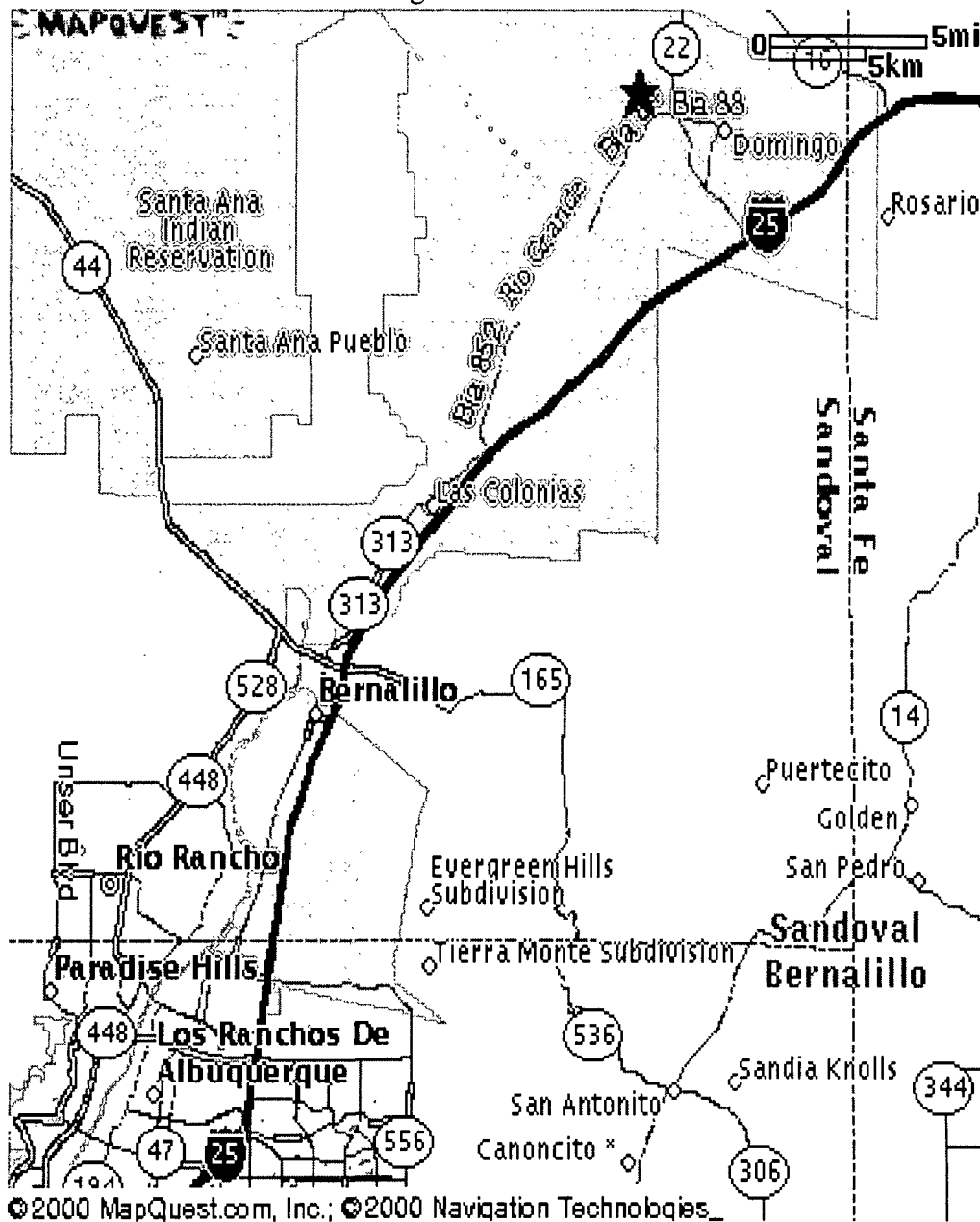


Fig. 1.0: Map showing location of Santo Domingo Pueblo (marked with a star) in reference to Albuquerque within the State of New Mexico.

3.4 Waste Characteristics

Residents of Santo Domingo claim through verbal testimony from that operators of the ATSF Railroad improperly disposed of waste at the Site. Wastes were dumped into the depressions on Site. A berm and an aerial photograph lead to evidence that the ground has been disturbed. The identity and quantity of substances dumped at the site are unknown.

Information about the specific materials and products used/disposed of on site is not available. A target compound list of volatiles, semivolatiles, pesticides/PCBs and heavy metals has been compiled (Reference 2). This sampling event will be a full suite analyses on all hazardous substances contained within the target compound list and target analyte list.

4.0 GROUND WATER PATHWAY AND TARGETS

4.1 Characteristics

A general characterization of site geology was requested of Dr. John Hawley, New Mexico Bureau of Mines, in 1994 by POEP staff for the Santo Domingo Landfill and the Abandoned Facility Site. This general information on the geology was collected for both of these sites and is within 1 mile of the Domingo Railroad Dumpsite. This existing information is relevant to the Railroad dumpsite and the information provided is based on a review of available geographic reports (Reference 1).

Dr. Hawley visited the Landfill Site as well as the Abandoned Facility Site and provides the following interpretation:

“The 20-acre landfill site (elevation 5320 to 5340 ft.) is located on the floor of a small tributary arroyo that joins Galisteo Creek (elev. 5270 ft.) about 0.5 mi to the north of the site near Domingo Siding of the ATSF Railroad. The confluence of the Galisteo Creek and the Rio Grande (elev. 5170 ft.) is located about 3.5 mi. to the west-northwest. I estimated that the base of the landfill trench is about 60 ft. above the shallow aquifer that underlies the channel of Galisteo Creek in Domingo. The top of the regional aquifer system that discharges to the Rio Grande Valley should be no deeper than 150 ft. below the site and is probably less than 100 ft. below the landfill base.”

“Reconnaissance geologic mapping of the general area by Kelly (1977), of nearby areas (Smith et. al., 1970; and Sterns, 1953), and observations suggest that the landfill is immediately underlain by two contrasting geologic units (in descending order):

1. Unconsolidated arroyo deposits of late Quaternary age that probably are less than 20 ft. thick and are primarily composed of coarse sandy to loamy sediments with thin lenticular beds of gravel and clay.
2. Partly consolidated basin fill correlated with the upper part of the Santa Fe Group of

late Pliocene. This unit consists of interbedded sand, gravel, and sandstone and conglomerate with thin beds of silt and clay; and it was deposited in the site area by the ancestral Rio Grande and tributary streams during major eruptive phases of the Jemez (silicic) and Cerros del Rio (basaltic) volcanic centers about 1.5 to 4.5 million years ago.

The contact of the upper and middle parts of the Santa Fe Group may be encountered at an elevation of about 5220 ft. (100-200 ft. below the site). This unit is better consolidated and contains more silt and clay than the upper Santa Fe beds. Its deposition also predates formation of the through-flowing Rio Grande drainage system. As already stated, however, these stratigraphic relationships can only be verified by detailed test drilling. The water table probably occurs in sandy, more permeable upper Santa Fe deposits; and there is no field evidence for predicting that any thick or continuous clay beds occur between the shallowest aquifer zone and the base of the landfill trenches."

The information provided here are regional geologic interpretations made during a reconnaissance of a nearby site. This information is to provide the reader with a general characterization of the geologic formations at or near the Domingo Railroad Dumpsite.

4.2 Ground Water Targets

The Pueblo of Santo Domingo relies primarily on two wells for drinking water. One well referred to as the EDA well, is located approximately 3 miles west of the site. The other well known as the Commercial Well is located approximately 3 miles south of the site. The Commercial well is on stand-by status and is connected to the public water supply system (Reference 1). The EDA well is the primary well that currently serves the Pueblo residents. There is information available from a Pilot Wellhead Protection Study report for the Pueblo that indicate high levels of sulfates, total dissolved solids, and extreme hardness in water from the EDA well. The Commercial Well however, produces considerably better water (Reference 1).

The residents Domingo receive their water from a well located 11 miles north of the site near the village of La Cienega, New Mexico (Reference 1). The approximate population distribution of the municipal system is shown in Table 1.0. According to tribal contacts at Santo Domingo Pueblo, there are 3 residential drinking wells located within ¼ mile down gradient of the Site. Two of the wells are in operation and the third one is not (Reference 1). The Bureau of Indian Affairs (BIA) installed 3 monitoring wells just approximately 0.5 miles North of the Site to monitor basic ground water parameters. Table 2.0 shows the wells that can be found in the four-mile radius of the Domingo Railroad Dumpsite. According to records obtained from the New Mexico State Engineers Office, there were approximately 17 wells identified within a four mile radius of the site (Reference 1).

5.0 SURFACE WATER PATHWAY

5.1 Hydrology and Climate

The climate of the Santo Domingo Pueblo area is mild with average daily temperatures ranging from 22° F to 47° in the winter months and 58° to 88°F during the summer months. The net

precipitation for this area is 12.58 inches with a 2-year 24-hour rainfall of 1.2 inches (Reference 1). The heaviest rains occur during the summer months of July and August. The site is situated in an area with foothills up- gradient and to the east. The Galisteo Creek runs north to south of the site. This creek reaches the Rio Grande (flowing from the north) at an estimated distance of 2.5 miles west. The site is on relatively flat terrain and there are no run on run off controls at the site (Reference 1). The 1992 Rio Grande flow rate at the San Felipe Gauging Station (approximately 9 miles south) is 1716 cubic feet per second. The up gradient drainage for the Rio Grande from this same station is 16,100 square miles (Reference 1). Galisteo Creek is a dry creek for the majority of the year with the exception of the heavy rainfall during the summer months. It has been determined that the Domingo Railroad Dumpsite is within the 100-year flood plain, this information was collected for the Abandoned Facility site about .5 miles from the Railroad Dumpsite and is relevant to this site (Reference 1).

5.2 Surface Water Targets

There are no drinking water intakes from surface water. There surface water is primarily used for irrigation. However the residents of Santo Domingo use the surface water for ceremonial purposes that may include drinking and bathing. Recreational activities may include swimming and fishing. The Rio Grande Silvery Minnow is a federally endangered species and has Critical Habitat designation in the Rio Grande River. The riparian habitat, bosque, along the Rio Grande is habitat for the Federally endangered species Bald Eagle and Southwestern Willow Flycatcher and the formerly listed Whooping Crane. Livestock cattle graze in the fields in and around the site and drink surface water sources (Reference 1). Targets in this pathway are only impacted if a potential release is suspected. Site-specific information on this matter is being studied and investigated currently about the operational history on this site.

6.0 SOIL EXPOSURE AND AIR PATHWAYS

6.1 Physical Conditions

The Domingo Railroad Dumpsite, as it exists today is currently inactive relative to railroad operations. There is a fence south of the Site delineating the site boundaries. Majority of the residents live within the 4-mile TDL (Target Distance Limit). Cattle are often seen grazing through the area; residents may still use the area for everyday farm duties or household tasks. The site is partially vegetated including juniper, sage, snakeweed, rabbit brush, thistle, and Indian rice grass.

6.2 Soil and Air Targets

There are no on-site workers as the site which is currently inactive. Residents nearest to the site are located approximately 100 yards north and west and 1 mile northwest (Reference 3). The approximation of the total number of residents of the Pueblo of Santo Domingo is 4136, this accounts for the residents living near the Site. Sensitive environments are the riparian habitat along the Rio Grande, which is an attractive habitat for the threatened-and-endangered Bald Eagle. Galisteo Creek, located 0.2 miles from the site is also a candidate for a sensitive environment. The residents of Santo Domingo still use the creek for hunting big game such as deer and elk. The federally endangered Black-footed Ferret is believed to inhabit areas near the site, but no reports exist regarding sightings of this species (Reference 3). The nearest school

and daycare facilities are in the Pueblo of Santo Domingo and are at distances greater the 3 miles from the Site.

Targets that may be impacted in these pathways are minimally affected. There is a potential threat to sensitive environments and species that are found within the TDL of the Site. The Bald Eagle however is frequently a concern in that it resides along the Rio Grande waterway, however, it is less frequently seen in the Site area.

7.0 SAMPLING ACTIVITIES

7.1 Objective of this SI Sampling

The principal objective of this sampling investigation is to identify the presence of hazardous substances associated with the historical uses of this site. The pathways to be investigated and sampled are the soil and groundwater pathways. Information about the historical uses of the site and visual observations during site reconnaissance were used to locate sampling points. Sampling points are placed at suspected source areas that are the disturbed ground from the aerial photograph, where depressions are shown at the surface, and along the parameter of the site.

7.2 Site Preparation for Sampling

Due to the site characteristics and safety hazards, and as standard SI procedures, the following site preparations and pre-sampling activities will be completed prior to commencement of sampling. Coordination and communication between onsite personnel and POEP is essential to the safe and effective completion of these activities.

7.2.1 Work Zones and Site Control

Designation and set up of the work zones, (exclusion zone/hot zone, decontamination zone, and support zone/command post) will be distinguished prior to sampling activities. There are no sanitary services or drinking water supply available on site. Detailed site control measures will need to be implemented due to the location of the site along a public road and near to residential homes. Personnel in charge of traffic control and community relations will need to be designated at the roadway.

7.2.2 Health and Safety Protocol

Prior to the initiation of site activities, all personnel to be working on site will have completed the required and appropriate training and certification. All personnel and visitors are required to read and sign the site specific health and safety plans.

7.2.3 On-site Air Monitoring

On November 15, 2001, POEP conducted Air Monitoring at the Site using Photo Ionization Detector (PID) and Radmeter to monitor for volatiles and radiation, respectively. All reading were non-detect with the exception of a brief low reading (5-7ppm) on the PID at the abandoned

foundation. This reading however could not be repeated and all subsequent readings were non-detect. Continual real-time air monitoring will be conducted during soil sampling to measure for VOCs, particulates, toxic gases, and combustible gases. Evacuation of all individuals in the hot zone and down wind of the site will be administered, if detections are of immediate danger. Any detections or instrument readings will be reported immediately to the Project, Site Health & Safety Manager(s).

7.2.4 Dust Control

The site is unpaved. Some activities at this site may cause disturbance of soil surface areas and contribute to airborne particulates. For localized dust control or dust suppression, portable water sprayers will be available, particularly for the soil sampling activities.

7.3 Ground Water Sampling

There are three groundwater wells planned for sampling as described in the following table. Please see site sketch for the sampling locations/justification. General chemistry parameters should be analyzed and recorded on-site during sampling and/or as part of laboratory analysis.

Table 3.0 Groundwater Samples

Sample Number	Location/Description
GW-1	RES #1 – sample from tap/closest to wellhead
GW-2	RES #2– sample from tap/closest to wellhead
GW-3	RES #3 – sample from wellhead

Purging of the third well prior to sampling will be conducted in accordance with standard procedures including the *US EPA Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures* (Reference 4). Due to the fact this is a drinking water well, purged well water will not be contained unless field evidence indicate any evidence of contamination. If contaminated, the proper containment, removal, transportation, and offsite disposal in compliance with federal regulations will be conducted.

7.4 Sediment Sampling

No sediment samples will be collected at this time.

7.5 Soil Sampling

There are 24 soil samples scheduled for this site inspection, including background and duplicate samples. These soil samples will be taken to assess possible contamination or release of hazardous substances, probable sources of contamination, and migration of those hazardous substances into the soil. The majority of the soil samples will be extracted from within a depth of 2 feet. The purpose for this depth is two fold: to comply with soil exposure pathway requirements, while also getting to a depth below any surface fill material or backfill material. Samples located at depths greater than 2 feet correspond to the waste dump areas. Please see site sketch for sample locations.

If at any time during soil sample collection, observations are made regarding the soil characteristics, such as change in color or texture, presence of odor, or readings on the monitoring instrument, these observations will be brought to the immediate attention of the site project manager(s) and health and safety officer(s).

7.6 Drilling Operation

To collect samples at depth the use of a mini drill rig is recommended and available. The potential source of contamination is buried waste including a caboose, which is expected to be buried at depths greater than 2ft. Contaminates of concern including heavy metals which would also be at depth and may not be detected at the surface. This will enable the evaluation of the risk to the groundwater pathway particularly the shallow groundwater table. Approximately four boreholes and eight samples are proposed (2 samples from each borehole at approximately 10 and 20 ft). Soil will be screened using standard headspace screening, and if clean then cuttings and decon water will be allowed to be disposed of on the ground. If headspace screening shows contamination then cuttings and decon water will be containerized until analytical results are available.

7.7 Air Sampling

There will be no air samples collected during this SI, except for continued air monitoring using the PID for health and safety purposes.

7.8 Laboratory/Analytical Requirements

The laboratory services requested are Routine Analytical Services (RAS) for the complete target analyte list (TAL) and the target compound list (TCL). For the soil samples, there are no known contaminants of concern since this is the purpose of the investigation. However, for the water samples, in addition to the investigation for the TAL/TCL contaminants, there are several potential contaminants of concern. These are phthalates, acetone (industrial grade acetone), PCBs, PAHs, lead, copper, and zinc. Since phthalates and acetone are also common laboratory contaminants, extra care in the handling of the samples will be required. The laboratory will be notified of the concern for these contaminants. All samples are expected to be shipped to a CLP laboratory with the exception of the drinking water samples. Drinking water samples are requested for the EPA Houston Laboratory. Full data validation is requested. Copies of the analytical results data package are requested to be sent to US EPA Region 6 Project Manager and to the POEP Project Manager.

7.9 Quality Control

All sampling procedures must comply with the requirements, instructions and guidance set forth in the following documents:

- The CLP Laboratory's Statement of Work;
- Sampler's Guide to the Contract Laboratory Program USEPA AOC, 1996;

- Data Quality Objectives Process for Hazardous Waste Site Investigations, EPA QA/G-4HW, Final, January 2000 .
- Data Quality Objectives Guidance (USEPA 1987).
- Applicable standard operating procedures established by the US EPA, and AIPC-POEP.

As a basic minimum requirement, one duplicate sample has been designated per matrix, at a frequency of one duplicate sample for every 20 samples collected per matrix.

8.0 PROJECT MANAGEMENT

This site is located in the Reservation of Santo Domingo Pueblo in which (the Governor) has overall authority for this site and activities associated with this project. It is important that all visitors understand and respect Tribal protocol and regulations. All visitors must check in with the Tribal Administration Office before going out to any areas within the Reservation. To facilitate this "check-in" procedure, the contractor will provide to POEP, a list of all personnel who will be arriving on site. The following table lists the key personnel and their phone numbers.

Project Management Personnel and Contacts

Name	Title	Telephone
Leandro Garcia	Santo Domingo Project Manager	(505) 465 - 2214
Ladonna Walker	US EPA Region 6 Project Manager	(214) 665 - 6666
Lisa Maiola	POEP Project Manager/POEP Environmental Scientist	(505) 884 - 0480 ext. 555
Linda Butler	POEP Sr. Environmental Scientist	(505) 884-0480 ext. 547
Damon Reyes	POEP Health & Safety Manager	(505) 884 - 0480 ext 590

8.1 Site Safety

All personnel at this site must meet and comply with US EPA and US OSHA regulations and guidance for hazardous waste site operations. Standard operating procedures for these activities must be followed. Site specific safety procedures for site access control, sampling actions, avoidance of hazards, use of personal protection equipment, and decontamination procedures will be detailed in writing and acknowledged by Santo Domingo Pueblo, POEP, US EPA and the Contractor prior to the commencement of work. Any person accessing the site during SI activities will need to be instructed on the site safety procedures. The site-specific safety issues are described in the POEP Site Specific Health and Safety Plan and the Contractor's Site Specific Health & Safety Plan. These documents will be attached separately.

8.2 Community Relations

As mentioned, (the Governor) has overall authority for the activities associated with this project including access to private lands and impacts to the community. Meetings have been held with Leandro Garcia, Tribal Programs Administrator and Project Contact regarding the status of this project. It is important that all visitors understand and respect the Tribal rules and regulations.

All visitors must check in with the Pueblo of Tribal Administration Office before going out to areas within the Reservation. There are two Tribal Officials on duty at all times. Due to the location of the site along a public road and the proximity to residential homes, special attention will be necessary for site control and communication with concerned residents and visitors, traveling through the area during the sampling activities.

8.3 Project Schedule

Mobilization to the site, set up and commencement of sampling activities is planned for January-February timeframe. The initial activities at the site will be work zone set-up, and air monitoring. Off site samples may be collected during this time. Once the air monitoring and subsurface investigation is complete, the on-site sampling activities will be conducted. Sampling is expected to take two days for completion.

9.0 LIST OF REFERENCES

1. AIPC POEP Superfund Program Preliminary Assessment Report, Domingo Railroad Dumpsite, dated August 27, 2001.
2. Volatiles Target Compound List, Semivolatiles Target Compound List, Pesticide/Aroclors Target Compound List, Inorganic Target Compound List.
3. POEP Site Reconnaissance notes, November, 2001.
4. Groundwater Well Sampling, US Environmental Protection Agency, 1995.
5. AIPC POEP Superfund Program Preliminary Assessment Report, Abandoned Facility Site, dated September 30, 1994.
6. Weather information-wind direction provided by NM State Climatologist Ted Sammis, Contact Report dated 1/9/01, and the National Oceanic and Atmospheric Administration Air Resources Laboratory, online Air Quality Dispersion and Trajectory Model (HYSPLIT), January 24, 2001.
7. US EPA Guidance for Performing Site Inspections under CERCLA, EPA/540-R-92-021. Data Quality Objectives Process for Hazardous Waste Site Investigations, EPA QA/G-4HW Final , US EPA EPA/600/R-00/007, January 2000.
8. Sampler's Guide to the Contract Laboratory Program, USEPA OSWER EPA/540/R-96/032 Measuring Contaminant Concentrations in Soil, USEPA Soil Screening Guidance, 5/96.

REFERENCE #1

POEP Preliminary Assessment, 2001
Domingo Railroad Dumpsite



PRELIMINARY ASSESSMENT

**DOMINGO RAILROAD DUMPSITE
PUEBLO OF SANTO DOMINGO, SANDOVAL COUNTY, NEW MEXICO
CERCLIS # NM0000605391**

PREPARED BY:

**ALL INDIAN PUEBLO COUNCIL
PUEBLO OFFICE OF ENVIRONMENTAL PROTECTION**

SUBMITTED TO:

**U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION VI, DALLAS, TEXAS**

AUGUST 27, 2001

REFERENCE #2

TCL & TAL LIST

LATILES TARGET COMPOUND LIST AND CONTRACT REQUIRED QUANTITATION LIMITS

Volatiles	CAS Number	Quantitation Limits			
		Water	Low Soil	Med. Soil	On Column
		µg/L	µg/Kg	µg/Kg	(ng)
1. Dichlorodifluoromethane	75-71-8	10	10	1200	(50)
2. Chloromethane	74-87-3	10	10	1200	(50)
3. Vinyl Chloride	75-01-4	10	10	1200	(50)
4. Bromomethane	74-83-9	10	10	1200	(50)
5. Chloroethane	75-00-3	10	10	1200	(50)
6. Trichlorofluoromethane	75-69-4	10	10	1200	(50)
7. 1,1-Dichloroethene	75-35-4	10	10	1200	(50)
8. 1,1,2-Trichloro- 1,2,2-trifluoroethane	76-13-1	10	10	1200	(50)
9. Acetone	67-64-1	10	10	1200	(50)
10. Carbon Disulfide	75-15-0	10	10	1200	(50)
11. Methyl Acetate	79-20-9	10	10	1200	(50)
12. Methylene Chloride	75-09-2	10	10	1200	(50)
13. trans-1,2-Dichloroethene	156-60-5	10	10	1200	(50)
14. Methyl tert-Butyl Ether	1634-04-4	10	10	1200	(50)
15. 1,1-Dichloroethane	75-34-3	10	10	1200	(50)
16. cis-1,2-Dichloroethene	156-59-2	10	10	1200	(50)
17. 2-Butanone	78-93-3	10	10	1200	(50)
18. Chloroform	67-66-3	10	10	1200	(50)
19. 1,1,1-Trichloroethane	71-55-6	10	10	1200	(50)
20. Cyclohexane	110-82-7	10	10	1200	(50)
21. Carbon Tetrachloride	56-23-5	10	10	1200	(50)
22. Benzene	71-43-2	10	10	1200	(50)
23. 1,2-Dichloroethane	107-06-2	10	10	1200	(50)
24. Trichloroethene	79-01-6	10	10	1200	(50)
25. Methylcyclohexane	108-87-2	10	10	1200	(50)
26. 1,2-Dichloropropane	78-87-5	10	10	1200	(50)
27. Bromodichloromethane	75-27-4	10	10	1200	(50)
28. cis-1,3-Dichloropropene	10061-01-5	10	10	1200	(50)
29. 4-Methyl-2-pentanone	108-10-1	10	10	1200	(50)
30. Toluene	108-88-3	10	10	1200	(50)
31. trans-1,3-Dichloropropene	10061-02-6	10	10	1200	(50)
32. 1,1,2-Trichloroethane	79-00-5	10	10	1200	(50)
33. Tetrachloroethene	127-18-4	10	10	1200	(50)
34. 2-Hexanone	591-78-6	10	10	1200	(50)
35. Dibromochloromethane	124-48-1	10	10	1200	(50)

Exhibit C -- Section 1
Volatiles (VOA)

1.0 VOLATILES TARGET COMPOUND LIST AND CONTRACT REQUIRED QUANTITATION LIMITS
(Con't)

Volatiles	CAS Number	Quantitation Limits			
		Water	Low	Med.	On
		ug/L	Soil ug/Kg	Soil ug/Kg	Column (ng)
36. 1,2-Dibromoethane	106-93-4	10	10	1200	(50)
37. Chlorobenzene	108-90-7	10	10	1200	(50)
38. Ethylbenzene	100-41-4	10	10	1200	(50)
39. Xylenes (total)	1330-20-7	10	10	1200	(50)
40. Styrene	100-42-5	10	10	1200	(50)
41. Bromoform	75-25-2	10	10	1200	(50)
42. Isopropylbenzene	98-82-8	10	10	1200	(50)
43. 1,1,2,2-Tetrachloroethane	79-34-5	10	10	1200	(50)
44. 1,3-Dichlorobenzene	541-73-1	10	10	1200	(50)
45. 1,4-Dichlorobenzene	106-46-7	10	10	1200	(50)
46. 1,2-Dichlorobenzene	95-50-1	10	10	1200	(50)
47. 1,2-Dibromo-3-chloropropane	96-12-8	10	10	1200	(50)
48. 1,2,4-Trichlorobenzene	120-82-1	10	10	1200	(50)

2.0 SEMIVOLATILES TARGET COMPOUND LIST AND CONTRACT REQUIRED QUANTITATION LIMITS

Semivolatiles	CAS Number	Quantitation Limits			
		Water µg/L	Low	Med.	On
			Soil µg/Kg	Soil µg/Kg	Column (ng)
49. Benzaldehyde	100-52-7	10	330	10000	(20)
50. Phenol	108-95-2	10	330	10000	(20)
51. bis-(2-Chloroethyl) ether	111-44-4	10	330	10000	(20)
52. 2-Chlorophenol	95-57-8	10	330	10000	(20)
53. 2-Methylphenol	95-48-7	10	330	10000	(20)
54. 2,2'-oxybis(1- Chloropropane) ¹	108-60-1	10	330	10000	(20)
55. Acetophenone	98-86-2	10	330	10000	(20)
56. 4-Methylphenol	106-44-5	10	330	10000	(20)
57. N-Nitroso-di-n propylamine	621-64-7	10	330	10000	(20)
58. Hexachloroethane	67-72-1	10	330	10000	(20)
59. Nitrobenzene	98-95-3	10	330	10000	(20)
60. Isophorone	78-59-1	10	330	10000	(20)
61. 2-Nitrophenol	88-75-5	10	330	10000	(20)
62. 2,4-Dimethylphenol	105-67-9	10	330	10000	(20)
63. bis(2-Chloroethoxy) methane	111-91-1	10	330	10000	(20)
64. 2,4-Dichlorophenol	120-83-2	10	330	10000	(20)
65. Naphthalene	91-20-3	10	330	10000	(20)
66. 4-Chloroaniline	106-47-8	10	330	10000	(20)
67. Hexachlorobutadiene	87-68-3	10	330	10000	(20)
68. Caprolactam	105-60-2	10	330	10000	(20)
69. 4-Chloro-3- methylphenol	59-50-7	10	330	10000	(20)
70. 2-Methylnaphthalene	91-57-6	10	330	10000	(20)
71. Hexachlorocyclo- pentadiene	77-47-4	10	330	10000	(20)
72. 2,4,6-Trichlorophenol	88-06-2	10	330	10000	(20)
73. 2,4,5-Trichlorophenol	95-95-4	25	830	25000	(50)

¹ Previously known by the name bis(2-Chloroisopropyl)ether.

Exhibit C -- Section 2
Semivolatiles (SVOA)

2.0 SEMIVOLATILES TARGET COMPOUND LIST AND CONTRACT REQUIRED QUANTITATION LIMITS (Con't)

Semivolatiles	CAS Number	Quantitation Limit			
		Water	Low Soil	Med. Soil	On Column
		$\mu\text{g/L}$	$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	(ng)
74. 1,1'-Biphenyl	92-52-4	10	330	10000	(20)
75. 2-Chloronaphthalene	91-58-7	10	330	10000	(20)
76. 2-Nitroaniline	88-74-4	25	830	25000	(50)
77. Dimethylphthalate	131-11-3	10	330	10000	(20)
78. 2,6-Dinitrotoluene	606-20-2	10	330	10000	(20)
79. Acenaphthylene	208-96-8	10	330	10000	(20)
80. 3-Nitroaniline	99-09-2	25	830	25000	(50)
81. Acenaphthene	83-32-9	10	330	10000	(20)
82. 2,4-Dinitrophenol	51-28-5	25	830	25000	(50)
83. 4-Nitrophenol	100-02-7	25	830	25000	(50)
84. Dibenzofuran	132-64-9	10	330	10000	(20)
85. 2,4-Dinitrotoluene	121-14-2	10	330	10000	(20)
86. Diethylphthalate	84-66-2	10	330	10000	(20)
87. Fluorene	86-73-7	10	330	10000	(20)
88. 4-Chlorophenyl-phenyl ether	7005-72-3	10	330	10000	(20)
89. 4-Nitroaniline	100-01-6	25	830	25000	(50)
90. 4,6-Dinitro-2-methylphenol	534-52-1	25	830	25000	(50)
91. N-Nitroso diphenylamine	86-30-6	10	330	10000	(20)
92. 4-Bromophenyl-phenylether	101-55-3	10	330	10000	(20)
93. Hexachlorobenzene	118-74-1	10	330	10000	(20)
94. Atrazine	1912-24-9	10	330	10000	(20)
95. Pentachlorophenol	87-86-5	25	830	25000	(50)
96. Phenanthrene	85-01-8	10	330	10000	(20)
97. Anthracene	120-12-7	10	330	10000	(20)
98. Carbazole	86-74-8	10	330	10000	(20)
99. Di-n-butylphthalate	84-74-2	10	330	10000	(20)
100. Fluoranthene	206-44-0	10	330	10000	(20)
101. Pyrene	129-00-0	10	330	10000	(20)
102. Butylbenzylphthalate	85-68-7	10	330	10000	(20)
103. 3,3'-Dichlorobenzidine	91-94-1	10	330	10000	(20)
104. Benzo(a)anthracene	56-55-3	10	330	10000	(20)
105. Chrysene	218-01-9	10	330	10000	(20)

2.0 SEMIVOLATILES TARGET COMPOUND LIST AND CONTRACT REQUIRED QUANTITATION
LIMITS (Con't)

Semivolatiles	CAS Number	Quantitation Limits			
		Water	Low Soil	Med. Soil	On Column
		µg/L	µg/Kg	µg/Kg	(ng)
106. bis(2-Ethylhexyl) phthalate	117-81-7	10	330	10000	(20)
107. Di-n-octylphthalate	117-84-0	10	330	10000	(20)
108. Benzo(b)fluoranthene	205-99-2	10	330	10000	(20)
109. Benzo(k)fluoranthene	207-08-9	10	330	10000	(20)
110. Benzo(a)pyrene	50-32-8	10	330	10000	(20)
111. Indeno(1,2,3-cd) - pyrene	193-39-5	10	330	10000	(20)
112. Dibenzo(a,h) - anthracene	53-70-3	10	330	10000	(20)
113. Benzo(g,h,i)perylene	191-24-2	10	330	10000	(20)

Exhibit C -- Section 3
Pesticides/Aroclors (PEST/ARO)

3.0 PESTICIDES/AROCLORS TARGET COMPOUND LIST AND CONTRACT REQUIRED
QUANTITATION LIMITS²

Pesticides/Aroclors	CAS Number	Quantitation Limits		
		Water µg/L	Soil µg/Kg	On Column (pg)
114. alpha-BHC	319-84-6	0.050	1.7	5
115. beta-BHC	319-85-7	0.050	1.7	5
116. delta-BHC	319-86-8	0.050	1.7	5
117. gamma-BHC (Lindane)	58-89-9	0.050	1.7	5
118. Heptachlor	76-44-8	0.050	1.7	5
119. Aldrin	309-00-2	0.050	1.7	5
120. Heptachlor epoxide ³	1024-57-3	0.050	1.7	5
121. Endosulfan I	959-98-8	0.050	1.7	5
122. Dieldrin	60-57-1	0.10	3.3	10
123. 4,4'-DDE	72-55-9	0.10	3.3	10
124. Endrin	72-20-8	0.10	3.3	10
125. Endosulfan II	33213-65-9	0.10	3.3	10
126. 4,4'-DDD	72-54-8	0.10	3.3	10
127. Endosulfan sulfate	1031-07-8	0.10	3.3	10
128. 4,4'-DDT	50-29-3	0.10	3.3	10
129. Methoxychlor	72-43-5	0.50	17	50
130. Endrin ketone	53494-70-5	0.10	3.3	10
131. Endrin aldehyde	7421-93-4	0.10	3.3	10
132. alpha-Chlordane	5103-71-9	0.050	1.7	5
133. gamma-Chlordane	5103-74-2	0.050	1.7	5
134. Toxaphene	8001-35-2	5.0	170	500
135. Aroclor-1016	12674-11-2	1.0	33	100
136. Aroclor-1221	11104-28-2	2.0	67	200
137. Aroclor-1232	11141-16-5	1.0	33	100
138. Aroclor-1242	53469-21-9	1.0	33	100
139. Aroclor-1248	12672-29-6	1.0	33	100
140. Aroclor-1254	11097-69-1	1.0	33	100
141. Aroclor-1260	11096-82-5	1.0	33	100

²There is no differentiation between the preparation of low and medium soil samples in this method for the analysis of pesticides/Aroclors.

³Only the exo-epoxy isomer (isomer B) of heptachlor epoxide is reported on the data reporting forms (Exhibit B).

Exhibit C -- Section 1
Inorganic Target Analyte List and CRQLs

1.0 INORGANIC TARGET ANALYTE LIST AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQLs)

Analyte	CAS Number	ICP-AES CRQL for Water ^{1,2,3,4} (µg/L)	ICP-AES CRQL for Soil ^{1,2,3,4,5} (mg/kg)	ICP-MS CRQL for Water ^{1,2,4} (µg/L)
Aluminum	7429-90-5	200	40	30
Antimony	7440-36-0	60	12	2
Arsenic	7440-38-2	15	3	1
Barium	7440-39-3	200	40	10
Beryllium	7440-41-7	5	1	1
Cadmium	7440-43-9	5	1	1
Calcium	7440-70-2	5000	1000	--
Chromium	7440-47-3	10	2	2
Cobalt	7440-48-4	50	10	0.5
Copper	7440-50-8	25	5	2
Iron	7439-89-6	100	20	--
Lead	7439-92-1	10	2	1
Magnesium	7439-95-4	5000	1000	--
Manganese	7439-96-5	15	3	0.5
Mercury	7439-97-6	0.2	0.1	--
Nickel	7440-02-0	40	8	1
Potassium	7440-09-7	5000	1000	--
Selenium	7782-49-2	35	7	5
Silver	7440-22-4	10	2	1
Sodium	7440-23-5	5000	1000	--
Thallium	7440-28-0	25	5	1
Vanadium	7440-62-2	50	10	1
Zinc	7440-66-6	60	12	1
Cyanide	57-12-5	10	1	--

¹The CRQLs are the minimum levels of quantitation acceptable under the contract Statement of Work (SOW).

²Subject to the restrictions specified in Exhibit D, any analytical method specified in ILM05.1 Exhibit D may be utilized as long as the documented Method Detection Limits (MDLs) are less than one-half the CRQLs.

³Mercury is analyzed by cold vapor atomic absorption. Cyanide is analyzed by colorimetry/spectrophotometry.

⁴Changes to the Inorganic Target Analyte List (TAL) (e.g., adding an additional analyte) or CRQLs may be requested under the flexibility clause in the contract.

⁵The CRQLs for soil are based on 100% solids. Samples with less than 100% solids may have CRQLs greater than those listed in the table above.

Exhibit C -- Section 2
Classical Chemistry Parameters and CRQLs

2.0 CLASSICAL CHEMISTRY PARAMETERS AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQLs)

Parameter	CRQL for Water ^{1,2,3} (mg/L)	CRQL for Soil ^{1,2,3,4} (mg/kg)
Alkalinity	2.0	
Ammonia, Nitrogen	0.10	
Biochemical Oxygen Demand	2.0	
Carbon, Total Organic	0.50	2000
Chemical Oxygen Demand	20.0	
Chloride	5.0	
Nitrate + Nitrite, Nitrogen	0.10	
Perchlorate	0.005	
Phosphorus, All Forms	0.10	
Solids, Total Dissolved	10.0	
Solids, Total Suspended	4.0	
Sulfate	10.0	
Hexavalent Chromium	0.010	0.40
Total Petroleum Hydrocarbons	2.0	50

¹The CRQLs are the minimum levels of quantitation acceptable under the contract Statement of Work (SOW).

²Subject to the restrictions specified in Exhibit D, any analytical method specified in ILM05.1 Exhibit D may be utilized as long as the documented Method Detection Limits (MDLs) are less than one-third of the CRQLs. For biochemical oxygen demand, the MDLs shall be less than 2 mg/L.

³Changes to the Classical Chemistry Parameters (e.g., adding dissolved organic carbon as a parameter or analyzing for nitrate and not nitrate + nitrite) or CRQLs may be requested under the flexibility clause in the contract.

⁴The CRQLs for soil are based on 100% solids. Samples with less than 100% solids may have CRQLs greater than those listed in the table above.

REFERENCE #3

POEP site Reconnaissance notes, 2001

n DOMINGO RAILROAD Date 8/1/01
DUMPSITE
/ Client PRE CERCLIS

E: PRAIRIE DOGS
- WY FLAT TERRAIN, NO RAN
UN OFF CONTROL ON SITE.
ENT LIVES APP. 5 MILES
THE SITE, ANOTHER IS APPROXIMATELY
E FROM THE SITE.
LOS
DX. 2:30 pm

LM 8/1/01

Location DOMINGO RAILROAD Date 11/15/01 13
DUMPSITE
Project / Client

Arrived at site around 1030 hrs
went to site
POEP project
Linda Butler - SR Environmental Scientist
Glenn Tortalita - Environmental Technician
Myself (Lisa) SFI Environmental Scientist
Partly Cloudy / approx 50°F / Light Breeze
USED THE PID/GPS UNIT / MEASURING
WHEEL TO DETERMINE THE AREA OF MY
SITE / RESIDENTS LIVE APP. 100 YDS NORTH.
WE SELECTED 4 CORNERS + TOOK MEASURE-
MENTS
① NE CORNER @ TEL. POLE NEXT TO
ARROYO
LAT 35° 30' 37.106" N
LONG 106° 18' 51.348" W
ALT 1609.34 m MSL
② SE CORNER AT FENCE BEHIND ARROYO
LAT 35° 30' 32.563" N
LONG 106° 18' 52.750 W
ALT 1625.63 m
11/15/01

12

14

Location

Domingo Railroad
Dumpsite

Date

11/15/01

Project / Client

③ SW CORNER ALT 1611.28 m (NEAR ST#
LAT. $35^{\circ} 30' 33.714''$ W
LONG $106^{\circ} 19' 33.7$ 06.028 W

④ NW CORNER
LAT. $35^{\circ} 30' 38.268''$ N
LONG $106^{\circ} 19' 05.995$ W
ALT. 1610.33

AT THE SITE WE NOTICED MORE DEAD
COWS / DEBRIS AT THE SITE.

APPROXIMATELY @ 1330 HRS WE MEET W
LEANDRO GARCIA, TRIBAL PROGRAMS ADMIN
FOR SANTO DOMINGO

→ HE ESCORTED US TO 3 RESIDENTIAL
HOMES SO WE COULD DETERMINE
HOW WE SHOULD SAMPLE THE WELLS
RESIDENT #1 - WAS HOME, CAN TAKE
SAMPLE FROM TAP

RESIDENT #2 - WELL H₂O SAMPLE CAN
BE TAKEN FROM TAP

RESIDENT #3 - WELL NEEDS TO BE PURGE.
LEFT SITE @ 1550 HRS.

11/15/01

Reference #4

Groundwater Well Sampling, 1995



GROUNDWATER WELL SAMPLING

SOP#: 2007
DATE: 01/26/95
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The objective of this standard operating procedure (SOP) is to provide general reference information on sampling of ground water wells. This guideline is primarily concerned with the collection of water samples from the saturated zone of the subsurface. Every effort must be made to ensure that the sample is representative of the particular zone of water being sampled. These procedures are designed to be used in conjunction with analyses for the most common types of ground water contaminants (e.g., volatile and semi-volatile organic compounds, pesticides, metals, biological parameters).

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedure employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

In order to obtain a representative groundwater sample for chemical analysis it is important to remove stagnant water in the well casing and the water immediately adjacent to the well before collection of the sample. This may be achieved with one of a number of instruments. The most common of these are the bailer, submersible pump, non-contact gas bladder pump, inertia pump and suction pump. At a minimum, three well volumes should be purged, if possible. Equipment must be decontaminated prior to use and between wells. Once purging is complete and the correct laboratory-cleaned sample containers have been prepared, sampling may proceed. Sampling may be conducted with any of the above instruments,

and need not be the same as the device used for purging. Care should be taken when choosing the sampling device as some will affect the integrity of the sample. Sampling should occur in a progression from the least to most contaminated well, if this information is known.

The growing concern over the past several years over low levels of volatile organic compounds in water supplies has led to the development of highly sophisticated analytical methods that can provide detection limits at part per trillion levels. While the laboratory methods are extremely sensitive, well controlled and quality assured, they cannot compensate for a poorly collected sample. The collection of a sample should be as sensitive, highly developed and quality assured as the analytical procedures.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The type of analysis for which a sample is being collected determines the type of bottle, preservative, holding time, and filtering requirements. Samples should be collected directly from the sampling device into appropriate laboratory cleaned containers. Check that a Teflon liner is present in the cap, if required. Attach a sample identification label. Complete a field data sheet, a chain of custody form, and record all pertinent data in the site logbook.

Samples shall be appropriately preserved, labelled, logged, and placed in a cooler to be maintained at 4°C. Samples must be shipped well before the holding time is up and ideally should be shipped within 24 hours of sample collection. It is imperative that samples be shipped or delivered daily to the analytical laboratory in order to maximize the time available for the laboratory to perform the analyses. The bottles should be shipped with adequate packing and cooling to ensure that they arrive intact.

Sample retrieval systems suitable for the valid collection of volatile organic samples are: positive displacement bladder pumps, gear driven submersible pumps, syringe samplers and bailers (Barcelona, 1984; Nielsen, 1985). Field conditions and other constraints will limit the choice of appropriate systems. The focus of concern must remain to provide a valid sample for analysis, one which has been subjected to the least amount of turbulence possible.

Treatment of the sample with sodium thiosulfate preservative is required only if there is residual chlorine in the water that could cause free radical chlorination and change the identity of the original contaminants. It should not be used if there is no chlorine in the water.

Holding time for volatiles analysis is seven days. It is imperative that the sample be shipped or delivered daily to the analytical laboratory. The bottles must be shipped on their sides to aid in maintaining the airtight seal during shipment, with adequate packing and cooling to ensure that they arrive intact.

For collection of volatile organic samples, refer to the work plan to ensure that 40 mL glass sample vials with Teflon lined septa are ordered and in sufficient numbers. Check sampling supplies; field kit for chlorine, preservatives, Parafilm, foam sleeves and coolers. Due to the extreme trace levels at which volatile organics are detectable, cross contamination and introduction of contaminants must be avoided. Trip blanks are incorporated into the shipment package to provide a check against cross contamination.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

4.1 General

The primary goal in performing groundwater sampling is to obtain a representative sample of the groundwater body. Analysis can be compromised by field personnel in two primary ways: (1) taking an unrepresentative sample, or (2) by incorrect handling of the sample. There are numerous ways of introducing foreign contaminants into a sample, and these must be avoided by following strict sampling procedures and utilizing trained field personnel.

4.2 Purging

In a nonpumping well, there will be little or no vertical mixing of the water, and stratification will occur. The well water in the screened section will mix with the groundwater due to normal flow patterns, but the well water above the screened section will remain isolated, become stagnant, and may lack the contaminants representative of the groundwater. Persons sampling should realize that stagnant water may contain foreign material inadvertently or deliberately introduced from the surface, resulting in an unrepresentative sample. To safeguard against collecting nonrepresentative stagnant water, the following guidelines and techniques should be adhered to during sampling:

1. As a general rule, all monitoring wells should be pumped or bailed prior to sampling. Purge water should be containerized on site or handled as specified in the site specific project plan. Evacuation of a minimum of one volume of water in the well casing, and preferably three to five volumes, is recommended for a representative sample. In a high-yielding groundwater formation and where there is no stagnant water in the well above the screened section, evacuation prior to sample withdrawal is not as critical. However, in all cases where the monitoring data is to be used for enforcement actions, evacuation is recommended.
2. When purging with a pump (not a bailer), the pump should be set at the screened interval, or if the well is an open-rock well, it should be set at the same depth the sample will be collected. When sampling a screened well, the sample should also be collected from the same depth the pump was set at.
3. The well should be sampled as soon as possible after purging.
4. Analytical parameters typically dictate whether the sample should be collected through the purging device, or through a separate sampling instrument.
5. For wells that can be pumped or bailed to dryness with the equipment being used, the well should be evacuated and allowed to

recover prior to collecting a sample. If the recovery rate is fairly rapid and time allows, evacuation of more than one volume of water is preferred. If recovery is slow, sample the well upon recovery after one evacuation.

6. A non-representative sample can also result from excessive pre-pumping of the monitoring well. Stratification of the leachate concentration in the ground water formation may occur, or heavier-than-water compounds may sink to the lower portions of the aquifer. Excessive pumping can dilute or increase the contaminant concentrations from what is representative of the sampling point of interest.

4.3 Materials

Materials of construction for samplers and evacuation equipment (bladders, pump, bailers, tubing, etc.) should be limited to stainless steel, Teflon[®], and glass in areas where concentrations are expected to be at or near the detection limit. The tendency of organics to leach into and out of many materials make the selection of materials critical for trace analyses. The use of plastics, such as PVC or polyethylene, should be avoided when analyzing for organics. However, PVC may be used for evacuation equipment as it will not come in contact with the sample, and in highly contaminated wells, disposable equipment (i.e., polypropylene bailers) may be appropriate to avoid cross-contamination.

Materials of construction (bladders/ pumps, bailers, tubing, etc.) suitable for collecting and handling Volatile Organic Samples should be limited to stainless steel, Teflon and glass in areas where detection limit range concentrations are expected. The tendency of organics to leach into and out of many materials, make the selection of materials critical for these trace analyses. The use of plastics, e.g., PVC etc., should be avoided. There are numerous ways of introducing foreign contaminants into a sample, and these must be avoided by following strict sampling procedures and utilization of trained personnel.

4.4 Advantages/Disadvantages of Certain Equipment

4.4.1 Bailers

Advantages

- C Only practical limitations on size and materials
- C No power source needed
- C Portable
- C Inexpensive, so it can be dedicated and hung in a well, thereby reducing the chances of cross contamination.
- C Minimal outgassing of volatile organics while sample is in bailer
- C Readily available
- C Removes stagnant water first
- C Rapid, simple method for removing small volumes of purge water

Disadvantages

- C Time-consuming to flush a large well of stagnant water
- C Transfer of sample may cause aeration
- C Stoppers at the bottom of the bailer usually leak thus the bailer must be brought to the surface rapidly
- C If the bailer is allowed to hit the bottom of the well boring, gravel can displace the ball valve not allowing the bailer to hold water

4.4.2 Submersible Pumps

Advantages

- C Portable and can be transported to several wells
- C Depending upon the size of the pump and the pumping depths, relatively high pumping rates are possible
- C Generally very reliable and does not require priming

Disadvantages

- C Potential for effects on analysis of trace organics
- C Heavy and cumbersome to deal with, particularly in deeper wells
- C Expensive
- C Power source needed
- C Sediment in water may cause problems with the pumps
- C Impractical in low yielding or shallow wells

4.4.3 Non-Contact Gas Bladder Pumps

Advantages

- C Maintains integrity of sample
- C Easy to use
- C Can sample from discrete locations within the monitor well

Disadvantages

- C Difficulty in cleaning, though dedicated tubing and bladder may be used
- C Only useful to about 100 feet
- C Supply of gas for operation, gas bottles and/or compressors are often difficult to obtain and are cumbersome
- C Relatively low pumping rates
- C Requires air compressor or pressurized gas source and control box

4.4.4 Suction Pumps

Advantages

- C Portable, inexpensive, and readily available

Disadvantages

- C Restricted to areas with water levels within 20 to 25 feet of the ground surface
- C Vacuum can cause loss of dissolved gases and volatile organics
- C Pump must be primed and vacuum is often difficult to maintain during initial stages of pumping

4.4.5 Inertia Pumps

Advantages

- C Portable, inexpensive, and readily available
- C Offers a rapid method for purging relatively shallow wells

Disadvantages

- C Restricted to areas with water levels within 70 feet of the ground surface
- C May be time consuming to purge wells with these manual pumps
- C Labor intensive
- C WaTerra pumps are only effective in 2-inch diameter wells

5.0 EQUIPMENT APPARATUS

5.1 Equipment Checklist

5.1.1 General

- C Water level indicator
 - electric sounder
 - steel tape
 - transducer
 - reflection sounder
 - airline
- C Depth sounder
- C Appropriate keys for well cap locks
- C Steel brush
- C HNU or OVA (whichever is most appropriate)
- C Logbook
- C Calculator
- C Field data sheets and samples labels

- C Chain of custody records and seals
- C Sample containers
- C Engineer's rule
- C Sharp knife (locking blade)
- C Tool box (to include at least: screwdrivers ,
pliers, hacksaw, hammer, flashlight ,
adjustable wrench)
- C Leather work gloves
- C Appropriate Health & Safety gear
- C 5-gallon pail
- C Plastic sheeting
- C Shipping containers
- C Packing materials
- C Bolt cutters
- C Ziploc plastic bags
- C Containers for evacuation liquids
- C Decontamination solutions
- C Tap water
- C Non phosphate soap
- C Several brushes
- C Pails or tubs
- C Aluminum foil
- C Garden sprayer
- C Preservatives
- C Distilled or deionized water
- C Fire extinguisher (if using a generator for
your power source)

5.1.2 Bailers

- C Clean, decontaminated bailers of appropriate
size and construction material
- C Nylon line, enough to dedicate to each well
- C Teflon coated bailer wire
- C Sharp knife
- C Aluminum foil (to wrap clean bailers)
- C Five gallon bucket

5.1.3 Submersible Pump

- C Pump(s)
- C Generator (110, 120, or 240 volt) or 12 volt
battery if inaccessible to field vehicle - amp
meter is useful
- C 1" black PVC coil tubing - enough to
dedicate to each well
- C Hose clamps
- C Safety cable
- C Tool box supplement
- pipe wrenches

- wire strippers
- electrical tape
- heat shrink
- hose connectors
- Teflon tape
- C Winch, pulley or hoist
- C Gasoline for generator/gas can
- C Flow meter with gate valve
- C 1" nipples and various plumbing (i.e., pipe
connectors)
- C Control box (if necessary)

5.1.4 Non-Gas Contact Bladder Pump

- C Non-gas contact bladder pump
- C Compressor or nitrogen gas tank
- C Batteries and charger
- C Teflon tubing - enough to dedicate to each
well
- C Swagelock fitting
- C Toolbox supplements - same as submersible
pump
- C Control box (if necessary)

5.1.5 Suction Pump

- C Pump
- C 1" black PVC coil tubing - enough to
dedicate to each well
- C Gasoline - if required
- C Toolbox
- C Plumbing fittings
- C Flow meter with gate valve

5.1.6 Inertia Pump

- C Pump assembly (WaTerra pump, piston
pump)
- C Five gallon bucket

6.0 REAGENTS

Reagents may be utilized for preservation of samples and for decontamination of sampling equipment. The preservatives required are specified by the analysis to be performed. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

7.0 PROCEDURE

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed (i.e., diameter and depth of wells to be sampled).
2. Obtain necessary sampling and monitoring equipment, appropriate to type of contaminant being investigated. For collection of volatile organic samples, refer to the work plan to ensure that 40 mL glass sample vials with Teflon lined septa are ordered and in sufficient numbers. Check sampling supplies; field kit for chlorine, preservatives, Parafilm, foam sleeves and coolers. Due to extreme trace levels at which volatile organics are detectable, cross contamination and introduction of contaminants must be avoided. Trip blanks are incorporated into the shipment package to provide a check against cross contamination.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Identify and mark all sampling locations.

7.2 Field Preparation

1. Start at the least contaminated well, if known.
2. Lay plastic sheeting around the well to minimize likelihood of contamination of equipment from soil adjacent to the well.
3. Remove locking well cap, note location, time of day, and date in field notebook or appropriate log form.
4. Remove well casing cap.

5. Screen headspace of well with an appropriate monitoring instrument to determine the presence of volatile organic compounds and record in site logbook.
6. Lower water level measuring device or equivalent (i.e., permanently installed transducers or airline) into well until water surface is encountered.
7. Measure distance from water surface to reference measuring point on well casing or protective barrier post and record in site logbook. Alternatively, if no reference point, note that water level measurement is from top of steel casing, top of PVC riser pipe, from ground surface, or some other position on the well head.

If floating organics are of concern, this can be determined by measuring the water level with an oil/water interface probe which measures floating organics.
8. Measure total depth of well (at least twice to confirm measurement) and record in site logbook or on field data sheet.
9. Calculate the volume of water in the well and the volume to be purged using the calculations in Section 8.0.
10. Select the appropriate purging and sampling equipment.
11. If residual chlorine is suspected, use the Hach Field Test Kit for chlorine to determine if there is residual chlorine in the water to be sampled. If there is, treat the sample via 1 with a crystal of sodium thiosulfate prior to sample collection.

7.3 Purging

The amount of flushing a well receives prior to sample collection depends on the intent of the monitoring program as well as the hydrogeologic conditions. Programs where overall quality determination of water resources are involved may require long pumping periods to obtain a sample that is representative of a large volume of that aquifer. The pumped volume can be determined prior to sampling so that the sample is

a collected after a known volume of the water is evacuated from the aquifer, or the well can be pumped until the stabilization of parameters such as temperature, electrical conductance, pH, or turbidity has occurred.

However, monitoring for defining a contaminant plume requires a representative sample of a small volume of the aquifer. These circumstances require that the well be pumped enough to remove the stagnant water but not enough to induce flow from other areas. Generally, three well volumes are considered effective, or calculations can be made to determine, on the basis of the aquifer parameters and well dimensions, the appropriate volume to remove prior to sampling.

During purging, water level measurements may be taken regularly at 15-30 second intervals. This data may be used to compute aquifer transmissivity and other hydraulic characteristics. The following well evacuation devices are most commonly used. Other evacuation devices are available, but have been omitted in this discussion due to their limited use.

7.3.1 Bailers

Bailers are the simplest purging device used and have many advantages. They generally consist of a rigid length of tube, usually with a ball check-valve at the bottom. A line is used to lower the bailer into the well and retrieve a volume of water. The three most common types of bailer are PVC, Teflon, and stainless steel.

This manual method of purging is best suited to shallow or narrow diameter wells. For deep, large diameter wells which require evacuation of large volumes of water, other mechanical devices may be more appropriate.

7.3.1.1 Operation

Equipment needed will include a clean decontaminated bailer, Teflon or nylon line, a sharp knife, and plastic sheeting.

1. Determine the volume of water to be purged as described in 8.0, calculations.
2. Lay plastic sheeting around the well to prevent contamination of the bailer line with

foreign materials.

3. Attach the line to the bailer and slowly lower until the bailer is completely submerged, being careful not to drop the bailer to the water, causing turbulence and the possible loss of volatile organic contaminants.
4. Pull bailer out ensuring that the line either falls onto a clean area of plastic sheeting or never touches the ground.
5. Empty the bailer into a pail until full to determine the number of bails necessary to achieve the required purge volume.
6. Thereafter, pour the water into a container and dispose of purge waters as specified in the site specific sampling plan.

7.3.2 Submersible Pumps

The use of submersible pumps for sample collection is permissible provided they are constructed of suitably noncontaminating materials. The chief drawback, however, is the difficulty avoiding cross-contamination between wells. Although some units can be disassembled easily to allow surfaces contacted by contaminants to be cleaned, field decontamination may be difficult and require solvents that can affect sample analysis. The use of submersible pumps in multiple well-sampling programs, therefore, should be carefully considered against other sampling mechanisms (bailers, bladder pumps). In most cases, a sample can be collected by bailer after purging with a submersible pump, however, submersible pumps may be the only practical sampling device for extremely deep wells (greater than 300 feet of water). Under those conditions, dedicated pump systems should be installed to eliminate the potential for cross-contamination of well samples.

Submersible pumps generally use one of two types of power supplies, either electric or compressed gas or air. Electric powered pumps can run off a 12 volt DC rechargeable battery, or a 110 or 220 volt AC power supply. Those units powered by compressed air normally use a small electric or gas-powered air compressor. They may also utilize compressed gases (i.e., nitrogen) from bottles. Different size pumps are available for different depth or diameter monitoring wells.

7.3.2.1 Operation

1. Determine the volume of water to be purged as described in 8.0 Calculations.
2. Lay plastic sheeting around the well to prevent contamination of pumps, hoses or lines with foreign materials.
3. Assemble pump, hoses and safety cable, and lower the pump in to the well. Make sure the pump is deep enough so all the water is not evacuated. (Running the pump without water may cause damage.)
4. Attach flow meter to the outlet hose to measure the volume of water purged.
5. Use a ground fault circuit interrupter (GFCI) or ground the generator to avoid possible electric shock.
6. Attach power supply, and purge the well until the specified volume of water has been evacuated (or until field parameters, such as temperature, pH, conductivity, etc, have stabilized). Do not allow the pump to run dry. If the pumping rate exceeds the well recharge rate, lower the pump further into the well, and continue pumping.
7. Collect and dispose of purge waters as specified in the site specific sampling plan.

7.3.3 Non-Contact Gas Bladder Pumps

For this procedure, an all stainless-steel and Teflon Middleburg-squeeze bladder pump (e.g., IEA, TIMCO, Well Wizard, Geoguard, and others) is used to provide the least amount of material interference to the sample (Barcelona, 1985). Water comes into contact with the inside of the bladder (Teflon) and the sample tubing, also Teflon, that may be dedicated to each well. Some wells may have permanently installed bladder pumps, (i.e., Well Wizard, Geoguard), that will be used to sample for all parameters.

7.3.3.1 Operation

1. Assemble Teflon tubing, pump and charged control box.
2. Procedure for purging with a bladder pump is

the same as for a submersible pump (Section 7.3.2.1).

3. Be sure to adjust flow rate to prevent violent jolting of the hose as sample is drawn in.

7.3.4 Suction Pumps

There are many different types of suction pumps. They include: centrifugal, peristaltic and diaphragm. Diaphragm pumps can be used for well evacuation at a fast pumping rate and sampling at a low pumping rate. The peristaltic pump is a low volume pump that uses rollers to squeeze the flexible tubing thereby creating suction. This tubing can be dedicated to a well to prevent cross contamination. Peristaltic pumps, however, require a power source.

7.3.4.1 Operation

1. Assembly of the pump, tubing, and power source if necessary.
2. Procedure for purging with a suction pump is exactly the same as for a submersible pump (Section 7.3.2.1).

7.3.5 Inertia Pumps

Inertia pumps such as the WaTerra pump and piston pump, are manually operated. They are most appropriate to use when wells are too deep to bail by hand, or too shallow or narrow (or inaccessible) to warrant an automatic (submersible, etc.) pump. These pumps are made of plastic and may be either decontaminated or discarded.

7.3.5.1 Operation

1. Determine the volume of water to be purged as described in 8.0, Calculations.
2. Lay plastic sheeting around the well to prevent contamination of pumps or hoses with foreign materials.
3. Assemble pump and lower to the appropriate depth in the well.
4. Begin pumping manually, discharging water into a 5 gallon bucket (or other graduate vessel). Purge until specified volume of water has been evacuated (or until field parameters such as temperature, pH,

conductivity, etc. have stabilized).

5. Collect and dispose of purge waters as specified in the site specific project plan.

7.4 Sampling

Sample withdrawal methods require the use of pumps, compressed air, bailers, and samplers. Ideally, purging and sample withdrawal equipment should be completely inert, economical to manufacture, easily cleaned, sterilized, reusable, able to operate at remote sites in the absence of power resources, and capable of delivering variable rates for sample collection.

There are several factors to take into consideration when choosing a sampling device. Care should be taken when reviewing the advantages or disadvantages of any one device. It may be appropriate to use a different device to sample than that which was used to purge. The most common example of this is the use of a submersible pump to purge and a bailer to sample.

7.4.1 Bailers

The positive-displacement volatile sampling bailer is perhaps the most appropriate for collection of water samples for volatile analysis. Other bailer types (messenger, bottom fill, etc.) are less desirable, but may be mandated by cost and site conditions.

7.4.1.1 Operation

1. Surround the monitor well with clean plastic sheeting. If using the GPI bailer, insert a vial into the claim and assemble the unit.
2. Attach a line to a clean decontaminated bailer.
3. Lower the bailer slowly and gently into the well, taking care not to shake the casing sides or to splash the bailer into the water. Stop lowering at a point adjacent to the screen.
4. Allow bailer to fill and then slowly and gently retrieve the bailer from the well avoiding contact with the casing, so as not to knock flakes of rust or other foreign materials into the bailer. If using the GPI bailer for collecting volatile organic samples,

once at the surface, remove the bailer from the cable. Carefully open the GPI bailer unit and remove the vial. Begin slowly pouring from the bailer, and collect the duplicate samples from the midstream sample.

5. Remove the cap from the sample container and place it on the plastic sheet or in a location where it won't become contaminated. See Section 7.7 for special considerations on VOA samples.
6. Begin slowly pouring from the bailer.
7. Filter and preserve samples as required by sampling plan.
8. Cap the sample container tightly and place prelabeled sample container in a carrier.
9. Replace the well cap.
10. Log all samples in the site logbook and on field data sheets and label all samples.
11. Package samples and complete necessary paperwork.
12. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

7.4.2 Submersible Pumps

Although it is recommended that samples not be collected with a submersible pump due to the reasons stated in Section 4.4.2, there are some situations where they may be used.

7.4.2.1 Operation

1. Allow the monitor well to recharge after purging, keeping the pump just above screened section.
2. Attach gate valve to hose (if not already fitted), and reduce flow of water to a manageable sampling rate.
3. Assemble the appropriate bottles.
4. If no gate valve is available, run the water

down the side of a clean jar and fill the sample bottles from the jar.

5. Cap the sample container tightly and place prelabeled sample container in a carrier.
6. Replace the well cap.
7. Log all samples in the site logbook and on the field data sheets and label all samples.
8. Package samples and complete necessary paperwork.
9. Transport sample to decontamination zone for preparation for transport to the analytical laboratory.
10. Upon completion, remove pump and assembly and fully decontaminate prior to setting into the next sample well. Dedicate the tubing to the hole.

7.4.3 Non-Contact Gas Bladder Pumps

The use of a non-contact gas positive displacement bladder pump is often mandated by the use of dedicated pumps installed in wells. These pumps are also suitable for shallow (less than 100 feet) wells. They are somewhat difficult to clean, but may be used with dedicated sample tubing to avoid cleaning. These pumps require a power supply and a compressed gas supply (or compressor). They may be operated at variable flow and pressure rates making them ideal for both purging and sampling.

Barcelona (1984) and Nielsen (1985) report that the non-contact gas positive displacement pumps cause the least amount of alteration in sample integrity as compared to other sample retrieval methods.

7.4.3.1 Operation

1. Allow well to recharge after purging.
2. Assemble the appropriate bottles.
3. Turn pump on, increase the cycle time and reduce the pressure to the minimum that will allow the sample to come to the surface.
4. Cap the sample container tightly and place

prelabeled sample container in a carrier.

5. Replace the well cap.
6. Log all samples in the site logbook and on field data sheets and label all samples.
7. Package samples and complete necessary paperwork.
8. Transport sample to decontamination zone for preparation for transport to analytical laboratory.
9. On completion, remove the tubing from the well and either replace the Teflon tubing and bladder with new dedicated tubing and bladder or rigorously decontaminate the existing materials.
10. Nonfiltered samples shall be collected directly from the outlet tubing into the sample bottle.
11. For filtered samples, connect the pump outlet tubing directly to the filter unit. The pump pressure should remain decreased so that the pressure build up on the filter does not blow out the pump bladder or displace the filter. For the Geotech barrel filter, no actual connections are necessary so this is not a concern.

7.4.4 Suction Pumps

In view of the limitations of these type pumps, they are not recommended for sampling purposes.

7.4.5 Inertia Pumps

Inertia pumps may be used to collect samples. It is more common, however, to purge with these pumps and sample with a bailer (Section 7.4.1).

7.4.5.1 Operation

1. Following well evacuation, allow the well to recharge.
2. Assemble the appropriate bottles.
3. Since these pumps are manually operated,

the flow rate may be regulated by the sampler. The sample may be discharged from the pump outlet directly into the appropriate sample container.

4. Cap the sample container tightly and place pre-labeled sample container in a carrier.
5. Replace the well cap.
6. Log all samples in the site logbook and on field data sheets and label all samples.
7. Package samples and complete necessary paperwork.
8. Transport sample to decontamination zone for preparation for transport to the analytical laboratory.
9. Upon completion, remove pump and decontaminate or discard, as appropriate.

7.4.6. Sample Retrieval - Syringe

A limited number of commercial syringe type samplers are available, (IEA, TIMCO, etc.) some are homemade devices. These devices are claimed to provide good quality samples for volatile analysis, but are severely limited in sample volume and are specific to sampling for volatiles. Essentially, they operate with an evacuated chamber that is lowered down the well, and allowed to fill with the pressure of the water. The entire mechanism is then brought to the surface with the sample. The sample may then be transferred to a sample vial, or the entire unit may be sent as the sample container.

1. Evacuate the syringe if necessary, and lower the sampling device to just below the well screen.
2. Remove the restriction from the device and allow the sample to fill the syringe, apply slight suction as necessary.
3. Bring unit to the surface. If necessary, transfer the sample to vials, as outlined in steps 2 through 7 above.

7.5 Filtering

For samples requiring filtering, such as total metals analysis, the filter must be decontaminated prior to and between uses. Filters work by two methods. A barrel filter such as the "Geotech" filter works with a bicycle pump, used to build up positive pressure in the chamber containing the sample which is then forced through the filter paper (minimum size 0.45 μm) into a jar placed underneath. The barrel itself is filled manually from the bailer or directly via the hose of the sampling pump. The pressure must be maintained up to 30 lbs/in² by periodic pumping.

A vacuum type filter involves two chambers; the upper chamber contains the sample and a filter (minimum size 0.45 μm) divides the chambers. Using a hand pump or a Gilian type pump, air is withdrawn from the lower chamber, creating a vacuum and thus causing the sample to move through the filter into the lower chamber where it is drained into a sample jar. Repeated pumping may be required to drain all the sample into the lower chamber. If preservation of the sample is necessary, this should be done after filtering.

7.6 Post Operation

After all samples are collected and preserved, the sampling equipment should be decontaminated prior to sampling another well to prevent cross-contamination of equipment and monitor wells between locations.

1. Decontaminate all equipment.
2. Replace sampling equipment in storage containers.
3. Prepare and transport ground water samples to the laboratory. Check sample documentation and make sure samples are properly packed for shipment.

7.7 Special Considerations for VOA Sampling

The proper collection of a sample for volatile organics requires minimal disturbance of the sample to limit volatilization and therefore a loss of volatiles from the sample.

Sample retrieval systems suitable for the valid collection of volatile organic samples are: positive displacement bladder pumps, gear driven submersible pumps, syringe samplers and bailers (Barcelona, 1984; Nielsen, 1985). Field conditions and other constraints will limit the choice of appropriate systems. The focus of concern must be to provide a valid sample for analysis, one which has been subjected to the least amount of turbulence possible.

The following procedures should be followed:

1. Open the vial, set cap in a clean place, and collect the sample during the middle of the cycle. When collecting duplicates, collect both samples at the same time.
2. Fill the vial to just overflowing. Do not rinse the vial, nor excessively overflow it. There should be a convex meniscus on the top of the vial.
3. Check that the cap has not been contaminated (splashed) and carefully cap the vial. Place the cap directly over the top and screw down firmly. Do not overtighten and break the cap.
4. Invert the vial and tap gently. Observe vial for at least ten (10) seconds. If an air bubble appears, discard the sample and begin again. It is imperative that no entrapped air is in the sample vial.
5. Immediately place the vial in the protective foam sleeve and place into the cooler, oriented so that it is lying on its side, not straight up.
6. The holding time for VOAs is seven days. Samples should be shipped or delivered to the laboratory daily so as not to exceed the holding time. Ensure that the samples remain at 4EC, but do not allow them to freeze.

8.0 CALCULATIONS

If it is necessary to calculate the volume of the well, utilize the following equation:

$$\text{Well volume} = \pi r^2 h (cf) \quad [\text{Equation 1}]$$

where:

$$\begin{aligned} \pi &= \text{pi} \\ r &= \text{radius of monitoring well (feet)} \\ h &= \text{height of the water column (feet)} \\ & \quad [\text{This may be determined by subtracting the depth to water from the total depth of the well as measured from the same reference point.}] \\ cf &= \text{conversion factor (gal/ft}^3\text{)} = 7.48 \text{ gal/ft}^3 \quad [\text{In this equation, 7.48 gal/ft}^3 \text{ is the necessary conversion factor.}] \end{aligned}$$

Monitor well diameters are typically 2", 3", 4", or 6". Knowing the diameter of the monitor well, there are a number of standard conversion factors which can be used to simplify the equation above.

The volume, in gallons per linear foot, for various standard monitor well diameters can be calculated as follows:

$$v(\text{gal/ft}) = \pi r^2 (cf) \quad [\text{Equation 2}]$$

where:

$$\begin{aligned} \pi &= \text{pi} \\ r &= \text{radius of monitoring well (feet)} \\ cf &= \text{conversion factor (7.48 gal/ft}^3\text{)} \end{aligned}$$

For a 2" diameter well, the volume per linear foot can be calculated as follows:

$$\begin{aligned} \text{vol/linear ft} &= \pi r^2 (cf) \quad [\text{Equation 2}] \\ &= 3.14 (1/12 \text{ ft})^2 7.48 \text{ gal/ft}^3 \\ &= 0.1632 \text{ gal/ft} \end{aligned}$$

Remember that if you have a 2" diameter well, you must convert this to the radius in feet to be able to use the equation.

The conversion factors for the common size monitor wells are as follows:

Well diameter	2"	3"	4"	6"
Volume (gal/ft.)	0.1632	0.3672	0.6528	1.4688

If you utilize the conversion factors above, Equation

1 should be modified as follows:

$$\text{Well volume} = (h)(cf) \quad [\text{Equation 3}]$$

where:

h = height of water column (feet)
 cf = the conversion factor calculated from Equation 2

The well volume is typically tripled to determine the volume to be purged.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, the following general QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.
3. The collection of rinse blanks is recommended to evaluate potential for cross contamination from the purging and/or sampling equipment.
4. Trip blanks are required if analytical parameters include VOAs.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA or REAC health and safety guidelines. More specifically, depending upon the site specific contaminants, various protective programs

must be implemented prior to sampling the first well. The site health and safety plan should be reviewed with specific emphasis placed on the protection program planned for the well sampling tasks. Standard safe operating practices should be followed such as minimizing contact with potential contaminants in both the vapor phase and liquid matrix through the use of respirators and disposable clothing.

When working around volatile organic contaminants:

1. Avoid breathing constituents venting from the well.
2. Pre-survey the well head-space with a non-FID/PID prior to sampling.
3. If monitoring results indicate organic constituents, sampling activities may be conducted in Level C protection. At a minimum, skin protection will be afforded by disposable protective clothing.

Physical hazards associated with well sampling:

1. Lifting injuries associated with pump and bailers retrieval; moving equipment.
2. Use of pocket knives for cutting discharge hose.
3. Heat/cold stress as a result of exposure to extreme temperatures and protective clothing.
4. Slip, trip, fall conditions as a result of pump discharge.
5. Restricted mobility due to the wearing of protective clothing.
6. Electrical shock associated with use of submersible pumps is possible. Use a GFCI or a copper grounding stake to avoid this problem.

12.0 REFERENCES

Barcelona, M.J., Helfrich, J.A., Garske, E.E., and J.P. Gibb, Spring 1984. "A Laboratory Evaluation of Groundwater Sampling Mechanisms," Groundwater

Monitoring Review, 1984 pp. 32-41.

Barcelona, M.J., Helfrich, J.A., and Garske, E.E. ,
"Sampling Tubing Effects on Groundwater Samples",
Analy. Chem., Vol. 57, 1985 pp. 460-463.

Driscoll, F.G., Groundwater and Wells (2nd ed.)
Johnson Division, UOP Inc., St. Paul, Minnesota ,
1986, 1089 pp.

Gibb, J.P., R.M. Schuller, and R.A. Griffin, .
Monitoring Well Sampling and Preservation
Techniques, EPA-600/9-80-010, 1980. March, 1980.

Instrument Specialties Company, (January) .
Instruction Manual, Model 2100 Wastewater Sampler,
Lincoln, Nebraska, 1980.

Keely, J.F. and Kwasi Boateng, Monitoring Wel l
Installation, Purging and Sampling Techniques - Part
I: Conceptualizations, Gro undwater V25, No. 3, 1987
pp. 300-313.

Keith, Lawrence H., Principles of Environmenta l
Sampling, American Chemical Society, 1988.

Korte, Nic, and Dennis Ealey,. Procedures for Field
Chemical Analyses of Water Samples, U.S .
Department of Energy, GJ/TMC-07, Technica l
Measurements Center , Grand Junction Project Office,
1983.

Korte, Nic, and Peter Kearl,. Procedures for th e
Collection and Preservation of Groundwater and
Surface Water Samples and for the Installation o f
Monitoring Wells: Second Edition, U.S. Department
of Energy, GJ/TMC-08, Technical Measurement s
Center, Grand Junction Projects Office, 1985.

National Council of the Paper Industry for Air and
Stream Improvement, Inc.,. A Guide to Groundwater
Sampling, Technical Bulletin No. 362, Madison, New
York. January, 1982.

Nielsen, David M. and Yeates, Gillian L., Spring. "A
Comparison of Sampling Mechanisms Available fo r
Small-Diameter Groundwater Monitoring Wells, "
Groundwater Monitoring Review, 1985 pp. 83-99.

Scalf, et al. (M.J. Scalf, McNabb, W. Dunlap, R .
Crosby, and J. Fryberger),. Manual for Groundwater
Sampling Procedures. R.S. Kerr Environmenta l
Research Laboratory, Office of Research and

Development. 1980, Ada, OK.

Sisk, S.W. NEIC Manual for Ground/Surface
Investigations at Hazardous Waste Sites ,
EPA-330/9-81-002, 1981.

U.S. Department of the Interior, National Handboo k
of Recommended Methods for Water-Dat a
Acquisition, Reston, Virginia.

U.S. Environmental Protection Agency, 1977 .
Procedures Manual for Groundwater Monitoring a t
Solid Waste Disposal Facilities. EPA-530/SW-611 .
August, 1977.

U.S. Code of Federal Regulations, 49 CFR Parts 100
to 177, Transportation revised November 1, 1985.

U.S. Environmental Protection Agency, 1982 .
Handbook for Chemical and Sample Preservation o f
Water and Wastewater, EPA-600/4-82-029 ,
Washington, D.C.

U.S. Environmental Protection Agency, 1983 .
Methods for Chemical Analysis of Water and Waste,
EPA-600/4-79-020, Washington, D.C.

U.S. Environmental Protection Agency, 1984. Tes t
Methods for Evaluation of Solid Waste ,
EPA-SW-846, Second Edition, Washington, D.C.

U.S. Environmental Protection Agency, 1981 .
Manual of Groundwater Quality Sampling Procedures,
EPA-600/2-81-160, Washington, D.C.

U.S. Environmental Protection Agency, 1985 .
Practical Guide for Groundwater Sampling ,
EPA-600/2-85/104, September, 1985.

U.S. Environmental Protection Agency, 1986. RCRA
Groundwater Monitoring Technical Enforcemen t
Guidance Document, OSWER-9950-1, September ,
1986.

Weston, 1987. Standard Operations Procedures fo r
Monitor Well Installation. MOUND IGMP/RIP.

U.S. Environmental Protection Agency, 1982 .
Handbook for Sampling and Sample Preservation o f
Water and Wastewater, EPA-600/4-82-029 ,
Washington, D.C.

--- 1981. Manual of Groundwater Quality

Sampling Procedures, EPA-600/2-81-160 ,
Washington, D.C.

--- 1985. Practice Guide for Groundwater
Sampling, EPA-600/2/85-104, September
1985.

Nielsen, David M. and Yeates, Gillian L., Spring
1985. "A Comparison of Sampling Mechanisms
Available for Small-Diameter Groundwater
Monitoring Wells," Groundwater Monitoring Review,
pp. 83-99.

WESTON, 1987. Standard Operating Procedures for
Monitor Well Installation. MOUND IGMP/RIP

Barcelona, M.J. Helfrich, J.A., and Garske, E.E. ,
"Sampling Tubing Effects on Groundwater Samples".
1985, *Analy. Chem.*, Vol. 57, pp. 460-463.

Tables

Table 1.0 Approximate Population Distribution for the Municipal System at Santo Domingo Pueblo

Well Name and Proximity to the site	Type of Well	Approximate Population Distribution
1. EDA Well (2 miles south)	Municipal	4136
2. Commercial Well (2 miles southeast)	Stand-By Municipal	-

Source (N.M. State Engineer, 1994; Garcia, 1994.

Table 2.0 Wells Within a Four-Mile Radius of the Domingo Railroad Dumpsite

Distance Category (miles)	Well Number/Name	Use	Approximate Number of Homes	Approximate Population
0 - 1/4	RES #1 RES #2 RES #3	Drinking	5	50
1/4 - 1/2	0	NA	7	50
1/2 - 1	RG 12460	Domestic/Sanitary	0	0
	RG 31932	Domestic/Sanitary		
	RG 31933	Observation		
	BIA MW #1	Monitoring		
	BIA MW #2	Monitoring		
	BIA MW #3	Monitoring		
1 - 2	RG 07817	Domestic/Sanitary	10	70
	RG 51583	Domestic/Sanitary		
	RG 00294	Not In Use		
	Windmill	Livestock Watering		
	Elementary School Well	Domestic		
2 - 3	PHS #2	Not In Use	450	3100
	Original Well	Not In Use		
	EDA Well	Municipal		
	Commercial Center Well	Stand-By Municipal		
3 - 4	RG 38170	Exploratory (4 Ea.)	133	925
	RG 34865	Domestic (Construction)		

(Reference 1)

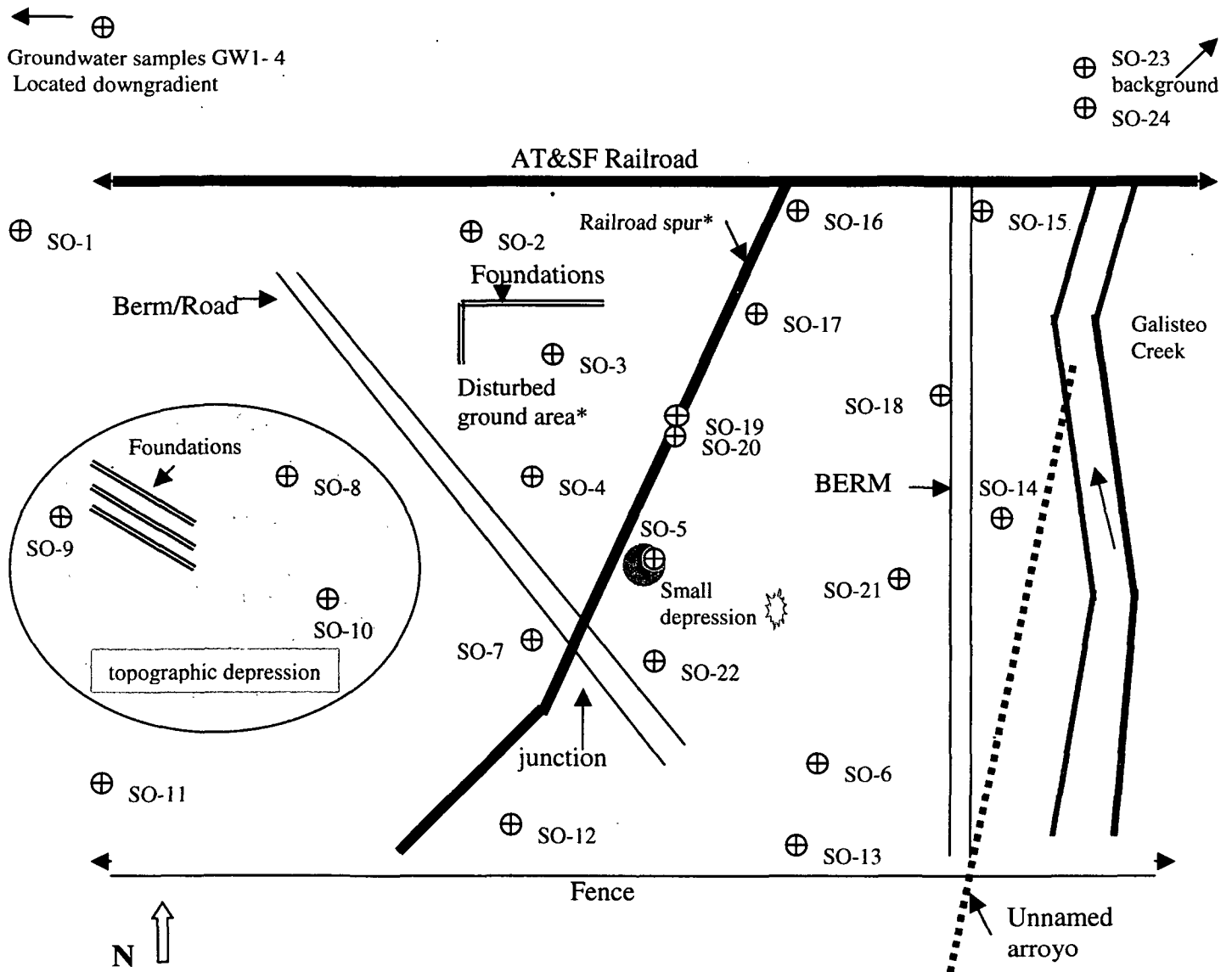
Table 3.0 Source/Soil Samples

Table 3.0 Source/soil samples.

SO-23 (Background)	Soil	Topographically up-gradient and approximately ½ miles Northeast of site.	Collected to determine background conditions in soils relative to site conditions.
SO-1	Soil	Northwest corner of site boundaries	Source/soil samples collected to determine contamination at the source, identify hazardous substances, and determine level of contamination.
SO-2	Soil	Just north of the foundation	
SO-3	Soil	In the area of the disturbed ground	
SO-4	Soil	Just south of disturbed ground	
SO-5	Soil	In small depression	Detonation of materials has possibly occurred in this depression
SO-6	Soil	Southeast corner of site boundary	Source/soil samples collected to determine contamination at the source, identify hazardous substances, and determine level of contamination.
SO-7	Soil	Near junction of spur and road	
SO-8	Soil	In topographic depression near foundation block	
SO-9	Soil	In topographic depression near foundation block	
SO-10	Soil	In topographic depression near foundation block	Source/soil samples collected to determine contamination at the source, identify hazardous substances, and determine level of contamination.
SO-11	Soil	Southwest corner of site	
SO-12	Soil	South center of site	
SO-13	Soil	Southeast corner of site	
SO-14	Soil	Between berm and arroyo	Source/soil samples collected to determine contamination at the source, identify hazardous substances, and determine level of contamination.
SO-15	Soil	Northeast corner of site	
SO-16	Soil	East side of RR Spur	
SO-17	Soil	East side of RR Spur	
SO-18	Soil	West side of berm	Source/soil samples collected to determine contamination at the source, identify hazardous substances, and determine level of contamination.
SO-19	Soil	On RR Spur	
SO-20 (duplicate of SO-19)	Soil	On RR Spur	
SO-21	Soil	West side of berm	
SO-22	Soil	South of small depression	Collected to determine background conditions in soils relative to site conditions.
SO-24 (duplicate of SO-23)	Soil	Topographically up-gradient and approximately ½ miles Northeast of site.	
GW-1	Residential Well	Near Mateo Overpass	Collected to determine possible contamination in the drinking water. All Residential Wells are located down gradient of the site.
GW-2	Residential Well	Domingo	
GW-3	Residential Well	Domingo	
GW-4	Residential Well	Domingo	

Site Maps/Sketch

Site Sketch Of Domingo Railroad Dumpsite



NOTES

* these areas correspond to the 2001 Historical Aerial Photographic Analysis Report indicating areas used by the railroad: a railroad spur and disturbed ground

⊕ Indicates sampling location

★ Small depression reported to be possible location of the point of detonation of materials

SITE SKETCH IS NOT TO SCALE

Photo Documentation

Photo #1



Description: This photo is taken southwest of the railroad, standing on the railroad spur. This is where the train would turn around or possibly dump materials here.

Date/Time: 8/1/01, 1220hrs

Weather: Partly cloudy, approximately 85° F

Photographer: Lisa Maiola, POEP, Environmental Scientist

Witness: Linda S. Butler, POEP, Environmental Scientist

Photo # 2



Description: This photo is taken facing North, focusing on the impression at the surface of the soil. This could be where the detonation of materials took place.

Date/Time: 8/1/01, 1320 hrs

Weather: Partly cloudy, approximately 85° F

Photographer: Lisa Maiola, POEP, Environmental Scientist

Witness: Linda S. Butler, POEP, Environmental Scientist

Photo #3



Description: This photo is taken facing west, these are remnants of a foundation that once stood here.

Date/Time: 8/1/01, 1322 hrs

Weather: Partly cloudy, approximately 85° F

Photographer: Lisa Maiola, POEP, Environmental Scientist

Witness: Linda S. Butler, POEP, Environmental Scientist

Photo #4



Description: This photo was taken facing southwest, between the spur and the road. These are remnants of a foundation found where there was disturbed ground on the site.

Date/ Time: 8/1/01, 1300 hrs

Weather: Partly cloudy, approximately 85° F

Photographer: Lisa Maiola, POEP, Environmental Scientist

Witness: Linda S. Butler, POEP, Environmental Scientist